A

FAMILIAR LECTURE

ILLUSTRATIVE OF THE

ARCHITECTURE

OF

THE HUMAN BODY;

EXHIBITING THE

Power, Wisdom, and Goodness of Almighty God

IN THE CREATION OF MAN.

TO WHICH IS ADDED,

A COMPLETE MANUAL OF ANIMAL CHEMISTRY.

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"What a piece of work is Man! how noble in reason! how infinite in faculties! in form and expression how admirable! in action how like an Angel! in apprehension how like a God."—Shakspeare.

INTENDED FOR THE RISING GENERATION.

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TO

SHARON TURNER, Esq., F. A. S. & R. A. S. L.,

Author of the "History of the Anglo-Saxons," "The Middle Ages," "The Modern History of England," and "The Sacred History of the World from the Creation to the Deluge."

My Dear Sir,

When I consider the great benefits you have conferred upon English Literature by your splendid intellectual acquirements, your arduous researches into the history of our country, and particularly by your last production (which ought to be perused by every individual), inasmuch as it not only instructs the reader in the nature of those objects which common observation has rendered familiar to him; but leads him to a contemplation of their great Creator, these of themselves would point you out as the fittest person to whom I could inscribe the following Lecture; but, when I look back upon the kind disinterested favours you have as generously conferred upon me, it then forms an additional reason why I should do so. I indulge in the hope that my humble endeavours to illustrate, in a familiar manner, the structure of the human body, may be so fortunate as to meet with your kind approbation; and trusting that Almighty God may enable you and your family to enjoy both happiness in this world and that which is to come, is the earnest prayer of

Your obliged and humble Servant,

H. W. DEWHURST.

October 15, 1834.

PREFACE.

SEVERAL years ago, during my pupillage, when in my eighteenth year, I was requested by a friend to give him an answer in writing to the following important question selected from holy writ:—

WHAT IS MAN?*

Accordingly, I wrote the principal portion of the following FAMILIAR LECTURE, and, having printed it, it not only met my friend's approbation, but likewise the heads of several highly respectable families; in fact, it pleased the gay, the thoughtless, and the grave; or, in other words, the public were pleased with it; among whom I may mention, with feelings of no small gratification, several of the learned bishops, dignitaries, and clergy of the Established and Roman Catholic churches, together with many eminent dissenting ministers of different religious persuasions; as the sentiments expressed in my DISCOURSE not only gave the youthful mind some general ideas of the human body, but conveyed them in a language intelligible to the most uneducated individual. Besides, its general tendency proves the wisdom, power, and goodness of Almighty God in the inimitable construction of our own frames.

From the above causes I attribute the favourable reviews by Mr. Chambers in the *Edinburgh Journal;* the late Rev. Dr. Drew in the *Imperial Magazine;* J. S. Buckingham, Esq., M. P., in the *Athenæum;* Professor Rennie; the Rev. Mr. Wrench, and other eminent characters; consequently, *five* large editions have been rapidly disposed of.

* Job. vii. 17.

A sixth having been called for by its friends and former patrons, their wishes are obeyed; and I may observe that the whole Lecture has been re-written, and considerably enlarged in every respect; so that if the former series were allowed to be good, this, I hope, will be considered better, and be found to deserve that kind patronage its predecessors enjoyed.

I may observe that this Lecture, in a more extended form, forms the introductory discourse to my popular Course of Lectures illustrative of the anatomical, physiological, chemical, and mechanical composition of man and animals; and which series has been delivered at the principal literary, scientific, and mechanics' institutions in London and its environs, and the principal provincial towns.

To the clergy of various denominations it is hoped this discourse will not prove unacceptable; for the pious and learned archbishop Tillotson lamented his ignorance of the subject, when descanting on the wisdom of God, in the creation of the world.*

* "The wisdom of God, in the frame of our bodies, very much appears by a curious consideration of the several parts of it; but that requiring a very accurate skill in anatomy, I choose rather wholly to forbear it, than by my unskilfulness to be injurious to the divine wisdom."—*Archbishop Tillotson's 83d Sermon.*

A

LECTURE

ILLUSTRATIVE OF THE

ARCHITECTURE OF THE HUMAN BODY,

&c.

"MAN, KNOW THYSELF."——*Delphic Oracle.*

MY YOUNG AND CHRISTIAN FRIENDS:

MAN is placed by an All-wise Providence at the head of the whole animal creation, who are made subservient to the gratification of his wants and necessities. In him we perceive a great chain of characters by which the Almighty has been pleased to distinguish him from the inferior classes of animals by whom he is daily more or less surrounded, and to whom he resembles in many points by their structure and functions. The most prominent feature is that man alone is intended to walk in the erect posture, an action no other creature is capable of performing, whilst the structure of the most perfectly formed monkey prevents the animal sustaining the upright position for any length of time without a great effort, or clinging to some external support.

Man is a being endowed with every sensible faculty; capable of doing good and evil; possessing a mind, in all probability, peculiar to him alone; furnished with a soul that affords him the most sublime ideas—ideas, which when promulgated from his fertile imagination, prove his great superiority over all other created beings. Those very thoughts which are constantly issuing from that mind, combined with a power granted to him alone, elevate him above every other production of an all-gracious and designing Deity (especially when he has the good fortune to be blessed with a liberal education), and make him an ornament to the society in which he circulates, and frequently of the greatest importance to his fellow creatures, by the exercise of his mysterious, intellectual, and inventive faculties.

The higher characteristics of man constitute his peculiarities. He possesses intelligence, and, phrenologically speaking, the prominent features of his mental powers are his *animal propensities;* by these he is placed on a par with the lower animals; thus enabling him to propagate and rear his offspring, and provide for their necessities;—his

moral sentiments govern his animal passions, and give him a sense of good and evil; lastly, his *intellectual faculties** stamp his importance and superiority, as composing the summit of the animal kingdom. These two last series (notwithstanding the erroneous and atheistical assertions of Robert Owen and his truly unfortunate deluded disciples;) resolve themselves into the sentiments of *conscientiousness, free-will,* a moral sense of right and wrong, and prove the existence

"Of a (Divine) First Great Cause,".

which the infidel is reluctantly compelled to admit. Man alone is blessed with a power (apparently denied to the lower animals) of communicating his thoughts, wishes, wants, and feelings; he alone can look back on, reflect, and contemplate the past; look forward, and calculate the destinies of the future: it is then that he feels as if an instinct informed him, or of a secret voice that warned him of his being by a divine Providence intended for a future and a higher destiny. This being the case, well might the immortal Dr. Young† exclaim,

"O! what a miracle to man is man!"

His structure actually astonishes us with the wondrous excellence of its delicate conformation. Let us philosophically examine the manner in which he is constructed, and we shall find that it is in perfect accordance with the most exact mechanical principles: investigating the heart and the blood-vessels, through which the vital fluid circulates, it is proved to be a perfect hydraulic machine, the heart being a most powerful engine by which the blood is propelled to the extremest part of the body; the lungs constitute an inimitable pneumatic apparatus; the beautiful membranes and transparent humours of the eye, forming an admirable optical instrument; in the same manner are the ears constructed on the most accurate principles of acoustics. Thus, on a very brief survey of our own bodies, our minds become duly elevated to a sense of admiration of the creative wisdom of the Omnipotent Architect of this vast universe; we are thus led from the study of the works of the Author of Nature up to Nature's God, in fact, as the Apostle St. Paul justly observes,—for

"In him we live, move, and have our being;"‡

and cannot but acknowledge ourselves as the work of a most skilful and unerring engineer. No just appreciation of the great powers and

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* These are situated in the forehead, which, when elevated like that of the late lord Byron, or expanded like that of the late emperor Napoleon, Dr. Franklin, and Mr. Canning, points out the grandeur of the intellectual character; but when receding, as in some individuals, or totally flat, as in the Carib and other Indians, it at once points them out as the lowest and most degraded of the human species, unless reformed by the delightful and cheering prospects of religion and Christianity. For an analysis of the mental faculties, the reader is referred to page 20.

† This illustrious clergyman was for many years rector of Welwyn, in Hertfordshire, where he died, and the only memorial to his revered remains is a small tablet fixed in the wall, so as scarcely to be perceived by the congregation of rustics who weekly assemble in that house of prayer. Although his "*Night Thoughts*" and other poems will carry down his name to posterity; yet his talents during life were *not* thought worth rewarding by the *powers* who *then* existed. Still it is lamentable that the present literary public have not raised a monument to him in Westminster Abbey, among the illustrious characters who there repose.

‡ Acts of the Apostles, chap. xvii. ver. 28.

wisdom of the Deity can be formed until we have investigated man, and compared his structure and character with the inferior orders of animals: of the truth of this the immortal Dr. Watts was convinced, when he said,

> "Though I could reach from pole to pole,
> And hold th' equator in my span;
> I must be measured by my soul,
> The mind 's the standard of the man."

The construction of the human body has been so beautifully paraphrased by the poet (Dr. Arbuthnot), that I cannot resist quoting him. He justly observes—

> "Am *I* but what I seem, *mere* flesh and blood,
> A branching channel, and a mazy flood?
> The purple stream that through my vessels glides,
> Dull and unconscious flows like common tides;
> The pipes through which the circling juices stray
> Are not that thinking I no more than they.
> This frame, *compacted with transcendent skill*
> Of moving joints, *obedient* to *my will*,
> Nursed from the fruitful glebe, like yonder tree,
> Waxes and wastes, I call it MINE, not ME.
> New matter still the mouldering mass sustains;
> The mansion *changed*, the tenant *still remains*;
> And, from the fleeting stream repair'd by food,
> Distinct as is the swimmer from the flood."

"Of dust thou art, and unto dust shalt thou return,"* said the Divine Creator to our first parents, when they, by their own disobedience to his commands, fell from a state of primeval bliss into sin, thereby entailing misery and death to their posterity; however, let us but for a moment look and examine of what materials we are composed. What an animated being is man! how vigorous and powerful he is! of what beautiful and complicated machinery is his graceful column formed! it being composed of bones† (articulations or), joints, arteries, and veins, clothed with muscles and integuments! see how duly it is balanced! how aptly it is contrived for his various movements! At the summit of this column is placed the head, specially appointed to this high situation

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* Genesis, chap. iii. v. 19.

† The number of bones in a human adult skeleton amounts to about 254, as follows:—

Appertaining	to the head	60
Ditto	to the trunk	56
Ditto	to the superior or pectoral extremities	72
Ditto	to the inferior or pelvic extremities	66
		254

Its weight varies at different periods of life, and, according to Söemmerring, a male skeleton weighs from 150 to 200 ounces. Dr. Craigie, of Edinburgh, weighed one, five feet six inches long, and it weighed 168 ounces, or 10½ lbs. avoirdupois. That of a female, according to the former anatomist, weighs from 100 to 150 ounces, and is, generally speaking, considerably smaller and more delicate than the male. The length of the osseous frame-work of an adult man is about an inch less than that of the body during life; that is to say, the skeleton of an individual five feet eight inches in height is about five feet seven inches long, and one of six feet about five feet eleven inches long. When the arms are stretched out on an angle with the body, the width from the tip of the longest finger on one hand to the same point in the other measures, generally speaking, the entire length of the body.

A skeleton is said to be *natural* when its bones are united by its own ligaments, and

from its containing the seat of sensation, the light of understanding, and the faculty of sight. In the cranium, or skull, is situated the brain, the *organ* of the immaterial principle. It is in the brain that the mind takes up its residence: here she holds communication with all the material things around her; from the brain she issues her commands, through the agency of the nerves, and the sensations are conveyed from all parts of the body to the brain. This organ being extremely tender and susceptible of injury, and the slightest local compression disturbing its action, it was necessary that it should be well protected from external violence. What, I will ask, could have been found more calculated for the defence of such a vital organ than the human skull? Had we no other proof of the existence of the Divine Architect than the structure of the human cranium it would be sufficient. Could man have formed a thing so well calculated to promote the object for which it was intended? Certainly not, with all his skill and ingenuity. The illustrious Lord Byron, in his beautiful lines on the human skull, thus appropriately remarks:—

"Observe this *skull* from out the scattered heaps,
Is this a temple where a God may dwell?—
Look on its broken arch, its ruined wall—
Its chambers desolate, and portals foul.
Yes, this was once Ambition's airy hall,
The dome of thought, the palace of the soul:
Behold, through each lack-lustre eyeless hole,
The gay recess of wisdom and of wit,
And passions hot that never brook'd control.
Can all saint, sage, or sophist ever writ,
People this lonely tower, this tenement refit?"

The human adult skull is composed of eight bones, some of which are separated from each other by zigzag or dove-tailed lines, called *sutures*. It is of an *arched form*, thereby calculated to withstand with impunity very severe blows. The form of an arch is universally allowed, by mechanics, to be the strongest thing in nature or art. It is not known at what time it was first used in works of art; but in all probability the hint was taken from nature. Let us compare the amazing strength of our modern stone bridges: Waterloo Bridge, in London, consists of nine arches, all of granite, and each stretching 150 feet! What a degree of force will the common watch-glass and the egg-shell bear, and how weak the same substances would be without the form of an arch!

The skull will frequently bear the most surprising degree of mechanical force applied to it without suffering any injury. It is composed of eight bones, united by dove-tailed lines or sutures; if it had consisted only of ONE solid bone,* it could not have answered every purpose for the defence of the brain. The division of the cranium into so

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artificial when conjoined by wire, catgut, string, or in fact any substance that did not form a portion of the individual during life. Artificial skeletons are the easiest to make, and look the neatest, but a natural skeleton displays patience and science on the part of the anatomist. Young animals, on account of the imperfect state of their bones, are generally prepared as natural skeletons, and the adult ones as artificial.

* In the skulls of old people, the sutures by which the bones composing the skull are connected frequently become obliterated, and their spaces filled up by a bony substance,

many bones enables it to grow much faster, and with greater facility. In the early fœtal state, as the first and second month after we are created, that which afterwards becomes the strong bony case of the brain, exists only as a tough flexible membrane.

Ossification, or the deposition of bony matter, commences in the middle of each bone long before birth ;* the brain soon appears as if it was covered by so many scales or shells held together by the membrane not yet ossified. In order to facilitate the birth of the child, those scales overlap each other, so as most usefully to diminish the size of the skull. If the cranium had only consisted of one bone, this provident design of nature could not have taken place. The dove-tailed joints by which the bones of the skull are connected are evidently of great utility in preventing the extension of fractures of the bones of the head; owing to the *sutures* which prevent the extension of the fracture, we generally find the effects of the injury confined to the bone on which the blow was received.

In no other part of animals do we see a greater instance of mechanical advantage, or lever power, than in the *lower jaw*. The temporal and masseter muscles pull almost *directly* at right angles to the line of the jaw; while in most other cases, as in that of the deltoid muscle lifting the arm, the muscles act *obliquely*, and with intensity diminished in proportion to their obliquity: an object placed between the back teeth is compressed with the whole direct power of the strong muscles of the jaw. Hence the human jaw can crush a body that resists with great force. The *teeth* form an extraordinary set of chisels and wedges for cutting and tearing the food. They are covered with a hard substance called enamel; on this account the teeth of many of the larger animals were used in former times for the same purposes as we now use steel, from the greater quantity of earth they contain. A set of small teeth appear soon after birth, and serve the child until the sixth or seventh year; these, in the course of time, fall out, and are replaced by larger ones, which last during a considerable period of our life. The number of teeth is only completed when the man or woman is full grown, by four more, called wisdom teeth.

In order to facilitate the various movements of the head backward and forward, and in the act of nodding, looking upward and downward, —to effect these extensive purposes, it moves as an articulated fulcrum or prop, on which it can turn either backward or forward, up or down, horizontally to the right or to the left. The two first movements are effected by a hinge-joint fitted to the *atlas* or first bone of the neck,

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when it assumes an appearance of being composed as it were but of one solid bone. Sometimes this phenomenon (indicative of advanced age) is perceived in the skulls of young individuals. I have in my craniological collection a skull, presented me several years ago by my obstetric friend Dr. Vön Heydeloff, wherein the sutures are perfectly obliterated, and yet the *dentes sapientiæ*, or *wisdom teeth*, had not made their appearance through the gums, although they had been formed within the sockets. Dr. Bruno states that when he had examined the head of the illustrious Lord Byron not a vestige of them remained: in fact it exhibited all the appearance of an octagenarian, although that nobleman was only thirty-seven years of age at the period of his lamented demise.

* In my museum I have the skeleton of a fœtus, between the third and fourth month after its original formation, wherein the rudiments of the various bones are beautifully exhibited; and in the Hunterian Museum of the Royal College of Surgeons, in London, similar appearances are shown in the skeleton of a fœtus *six weeks* after conception.

but limited by ligaments, in its movements backward and forward, to prevent suffocation. The horizontal motion is effected by a peculiar auxiliary placed on the bone below the first vertebra. It is a process of bone resembling a tooth,* which fits into a pivot of the bone above it, and serves as an axle for the head to turn, but only to a limited extent,† the muscles on each side protecting it from danger.

The spinal, or back bones, have various uses and amazing powers that can never be wholly investigated; yet the reflective man can perceive sufficient of the magnificent design to compel him to adore and venerate the superior excellence of his God!

The spine, in figure, resembles, in some degree, an Italic *f*, and consists of twenty-four vertebræ, or bones, joined together by smooth-rubbing surfaces, and connected to each other by very strong intervening cartilages, more correctly termed intervertebral substance, which is extremely pliable, allowing great motion to the bones, and preventing their separation from one another, which would be followed by a material injury to the spinal marrow, and consequently to the destruction of life. The spine is the centre pillar, on the top of which the head is situated; its use is to contain a prolongation of the brain, called the *spinal marrow*, which is of the greatest importance to animal life: if it is injured in the slightest degree, immediate death, or a paralysis of the parts below the injured portion, are the consequences. Consequently, in unison with all the works of the Creator, we find the spine uniting with great strength, great elasticity and flexibility. The spine is susceptible of the greatest variety of motion;‡ if it had only consisted of one bone, no motion could have taken place, and the spinal marrow would have been rendered more liable to injury. Those horrible distortions of the spine so often seen in highly civilized circles are the effects of a disease of the intervertebral substance between the bones of the spine, and likewise of the bones of the spinal column themselves, created by that disgraceful system of tight-lacing the stays by fashionable females. And if we make a comparison of the skeleton of a lady of high life with that of a female who has lived in a state of nature, or without wearing such a ridiculous and injurious article of dress, they will speak volumes to an unprejudiced mind against the continuance of their employment.

From the spinal marrow, the nerves supplying some of the principal organs in the chest, abdomen, and pelvis, as also the inferior extremities, receive their origin. The spine affords support to all the muscles of the trunk; the ribs are articulated into the vertebræ of the back. "Were an artist," says an eminent author, "to attempt to form a chain, which should be capable of supporting a weight perpendicularly, and at the same time flexible, he would compose it of strong and short links, and endeavour to combine flexibility and strength, so as to act in opposition to each other; but he would find it very difficult to effect his purpose, even for the support of a small weight in this manner."

There are twenty-four bones in the human spine, joined to each other by broad bases; in some parts these bases are shallower than in

* Hence its name—Vertebra Dentata, or axis of the neck.

† In birds there is a perfect ball and socket joint between the occipital bone and the first vertebra of the neck, thus enabling the animal to move his head in every direction.

‡ As an example, notice the contortions of harlequins, posture-masters, &c.

others, according as they are to serve more immediately either the purposes of flexibility or strength. In the back, where strength is most wanted, they are firmer than in the loins, where flexibility is necessary; and still firmer in the neck, where the erect posture is chiefly required. Each of these bones is perforated through the middle, and so placed over and under those next to it as to form a close canal for the medullary substance. To prevent this passage from being disturbed on change of posture by the vertebræ shifting over one another, these bones are supplied with cartilages, which, being of an elastic and yielding nature, allow of these motions without separation of the bones themselves.

I may mention a curious fact, but yet a truism, that we are taller in the morning when we rise from our bed than when we retire to it; for this reason, the weight of the body compresses the cartilages between the bones of the spine, which are restored partly by their elasticity, and partly from the superincumbent weight being removed during the horizontal position we assume when at rest.

The foot of man forms a most beautiful *arch*, from the back part of the *os calcis*, or *heel-bone*, to the extremities of the toes; and when the two feet are parallel to each other, as when a foot-soldier is standing under arms, then another arch is formed in a transverse direction, from the outer extremity of the foot on the one side to the same part in the opposite foot; by this means the human body is supported upon three arches (two longitudinal, and one transversely), and thereby is enabled to stand erect without artificial assistance; thus proving his great superiority over all other created beings.

On the various joints of the bones much of their different effects depend. Each is mechanical, and resolvable by human reason. There are two principal sorts of joints; viz. *ball and socket*, and the *hinge joint;* one or the other is used according to the extent of motion required. At the knee (the most complicated in structure) a hinge answers the purpose of moving the leg backwards and forwards: at the hip, a ball and socket serves to co-operate with the motion of the leg, and to move the limb to the right or left in any required position. The shoulder-joint is a ball and socket; but the socket here is very shallow, with a cartilage round its margin, while the cup of the thigh-bone is very concave, and formed of more solid materials. These differences agree with the situations of each of them, and the purposes they are separately to answer; for, as the one is a principal instrument of motion, the shallowness of the socket, and the flexibility of the cartilage, form its motion; while in the thigh and leg, which are to support the body, firmness is likewise necessary, which has been conceived in the formation of the joints connected with them. In all the joints of the body the ends of the bones are covered with cartilage, to prevent injury by the friction of hard substances. The ball, or head of the thigh-bone, is tipped, and the cup lined, with this yielding substance; and the hip-joint is protected by it. Each joint is supplied with a fluid, denominated by anatomists *synovia*, by butchers *joint-oil*, which prevents the dreadful effects of friction.

Having considered the joints on which animal motions depend, we may next contemplate the mechanism by which these motions are generated and supported. The muscles and their tendons are not only constitutionally endowed to generate and regulate motion, but also differ-

ently constructed for these purposes, according to the movement required and the instruments used. For example, at the knee and elbow, where the joint is large, which serves only to move the limb in the same plane, the tendons are placed parallel to them, and lengthen or shorten in that direction; but in the hip and shoulder, where the ball and socket joint is found, the muscles are variously placed, and are capable of contracting and restoring themselves in each position. The muscles also, by their different directions, support the bones, particularly the head; and all the limbs are regulated in their movements chiefly by their agency. For the muscles cannot expand beyond their natural size, though they can contract; therefore, to produce a contrary motion, another muscle must be called into action: it is by this contrary motion of the muscles of the face that the features are duly balanced in their places. The natural strength of the muscles may be either increased or diminished by exercise; for we perceive the legs of a dancing-master, the arms of a pugilist, waterman, or anchor-smith, are stronger by use. All the limbs of the body are levers of the third class; for the resistance must be farther from the prop than the power, the power being in the joint itself; yet all is easy, no difficulty arises:—

"For it is the work of an Almighty God."

In some parts of the body, where the tendons of one muscle pass over those of another, is a beautiful apparatus containing *synovia*, a fluid generally known by the name of *joint-oil*, similar to a bag; these are called *bursæ mucosæ;* by this means the danger from friction is avoided.

Muscles in general are pairs (with one or two exceptions we find them single, as the circular muscle of the mouth, &c.) Their number has been estimated at two hundred and eighty-nine; but as they are the same on both sides this must be doubled, which makes five hundred and seventy-eight, an enumeration which is pretty nearly correct.

All animal motion is effected by the muscles. They are divided into two great classes, viz. the *voluntary* and *involuntary;* those under the influence of the *will*, as the muscles of the arm and leg, &c.; and those whose action is independent of the will, as the *heart*, &c., which is merely a hollow muscle for the purpose of receiving the blood, and propelling it by means of arteries to all parts of the body. Each muscle has an antagonist muscle, viz. one that acts in a direction contrary to the other: for example, two muscles throw the arm out, which are called the extensors; and two others bend the arm, and are called the flexors; one muscle relaxes while the other contracts. Nothing is satisfactorily known about muscular contraction: this physiological question is not decided. The muscles are supplied with nervous energy by means of white cords called nerves, which arise from the brain and spinal marrow; we know nothing of the nature of this principle circulating in nerves; we can only witness its effects. That nervous energy is necessary to the healthy performance of the various functions of the body, there can be no doubt. Digestion, secretion, sight, hearing, smelling, tasting, &c., cannot be effected if the nerve of communication between their respective functions and the brain be divided.

The body is supported by the blood, which is circulated by means of tubes denominated arteries and veins; the former carrying it from, and

the latter returning it to, the heart, which organ gives a motion to the arteries, synchronous with the heart itself, and extending to the extremest ramification in the body; this motion we denominate the pulse. Thus is man a complete piece of machinery, the whole of which is put into action by means of a power derived from the brain through the agency of its nerves. The vital fluid passes from the heart into the lungs in a state dangerous to the preservation of life, being loaded with carbon, which it gives off in these organs, on receiving a due proportion of oxygen from the atmosphere, and the blood becomes purified and fit for the support of animal life. It circulates from the heart of a bright scarlet colour, and returns again to this organ of a reddish black, united with a great quantity of carbon, which it has obtained in the course of its circulation, after it has performed the trifold offices of *secretion, nutrition*, and *vivification*, or the *preservation of life;* while the digestive organs perform their due offices, create the various secretions, and form new blood in lieu of that which is expended.

The arterial blood is distributed from the *left* or *aortic* side of the heart all over the body, by means of the greatest *artery* or blood-vessel called the *aorta*, which subdivides in its course, and ultimately terminates in myriads of very minute ramifications, closely interwoven with, and in reality constituting a large portion of, the texture of every living part. On reaching this extreme point of its course, the blood passes into equally minute ramifications of the veins, which, in their turn, gradually coalesce and form larger and larger trunks, till they at last terminate in two large veins, by which the whole current of the venous blood is brought back in a direction contrary to that in the arteries, and poured into the *right* or *cavic* side of the heart. On examining the quality of the blood in these two systems of vessels, it is found to have undergone a great change in its passage from the one to the other. The florid hue which distinguishes it in the arteries has disappeared, and given place to the dark colour characteristic of venous blood. Its properties have also changed, and it is now no longer capable of sustaining life. Two conditions are essential to the reconversion of venous into arterial blood, and to the restoration of its vital properties. The first is *an adequate provision of new materials from the food*, to supply the place of those which have been expended in nutrition; and the second is *the free exposure of the venous blood to the atmospheric air*. The first condition is fulfilled by the chyle or nutrient principle of the food being regularly poured into the venous blood just before it reaches the right side of the heart; and the second, by the very important process of respiration which takes place in the air-cells of the lungs, and which it is my present object to explain. The venous blood, having arrived at the right side of the heart, is propelled by the contraction of that organ into a large artery, leading directly, by separate branches, to the two lungs, and hence called the *pulmonary* artery. In the innumerable branches of this artery, expanding themselves throughout the substance of the lungs, the dark blood is subjected to the contact of the air inhaled in breathing; and a change in the composition both of the blood and of the inhaled air takes place, in consequence of which the former is found to have assumed its florid or arterial hue, and to have regained its power of supporting life. The blood then enters minute venous ramifications, which gradually coalesce into larger branches, and

at last terminate in four large trunks in the *left* or *cavic* side of the heart; whence the blood in its arterial form is again distributed over the body, to pursue the same course and undergo the same changes as before. The exposure of the blood to the action of the air seems to be indispensable to every variety of animated creatures. In man, and the higher classes of animals, it is carried on in the lungs, the structure of which is admirably adapted for the purpose. In many animals, however, the requisite action is effected without the intervention of lungs. In fishes, for example, who live in a dense medium, and do not breathe, the blood circulates through the gills; which, being constantly and directly in contact with the water, are therefore more accessible to the action of the air the water contains, and much better adapted than lungs would be to the medium in which fishes live. In worms, on the other hand, and many similar animals, no distinct organ is set apart for the purpose; but the aëration of the blood takes place at the surface of the body by means of pores in the skin called *spiraculæ*, specially adapted to this end, and which cannot be shut up or obstructed, any more than the real lungs or gills, without inducing death. So necessary, indeed, is atmospheric air* to the vitality of the blood in all classes of animals, that its abstraction inevitably induces death; and a fish can no more live in water deprived of air than a man could in an atmosphere deprived of oxygen. And thus the fish requires a renewal of air, and perishes when it is denied, exactly as man does in similar circumstances.

The blood in an adult human body has been estimated to circulate throughout the whole system in four hours, or about six times in the course of a single day. Its quantity has been estimated by Bartholine† to be about twenty-four pounds, and Sir Charles Bell‡ considers thirty-three pounds as the average proportion, but in my opinion its exact quantity can never be truly ascertained.

By means of the beautiful mechanism of the heart and lungs is the important function of the circulation of the blood accomplished; and there is no portion of physiological research which displays greater perfection of design, a more admirable and splendid contrivance, or more ingenious machinery than is exhibited in the formation of the heart and its vessels. The exquisite construction of even the most minute organ, and the harmonious sympathy pervading the whole, are objects of wonder, and must ever excite the veneration and admiration of all who delight to search after and contemplate the more elaborate works and unerring operations of the great Author of Nature. Well may we exclaim with the illustrious Addison,

"That the hand who made us is divine."

Or with the unfortunate Thomson, the inimitable author of the Seasons:

"'Tis surely God
Whose unremitting energy pervades,
Adjusts, sustains, and agitates the whole;
He ceaseless works alone, and yet alone
Seems not to work, yet with such perfection framed
Is this complex stupendous scheme of things."

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* Atmospheric air is composed of twenty-one parts of a *gas* called *oxygen* (which is the most important part, being equally indispensable to life and combustion), and seventy-nine *azote* or *nitrogen*. The air contains other matter, always a little water in suspension, frequently a little carbonic acid gas, and many aromatic particles.

† The discoverer of the lymphatic system of vessels. ‡ Animal Mechanics, part II.

In the abdomen we have the liver, stomach, intestines, and pancreas,* for the performance of the functions of digestion; and the kidneys, for eliminating the superfluous quantity of fluid formed in the system.

I have already stated that an animal body is supported by means of blood, which is carried from the heart by means of tubes called arteries, and circulated by these through all parts of the body, and conveyed back again to the heart by veins. The nutritious portions of the various kinds of food we daily swallow are converted into blood. After masticating our food it mixes with the saliva of the mouth, and is conveyed in a pulpy state to the stomach: it is there acted upon by a juice secreted by glands within the coats of the stomach called *gastric* juice, which converts the food into *chyle;* it then passes from the stomach in this state into the first of the small intestines called the *duodenum,* where the nutritive part becomes separated from the feculent, and is converted into *chyle,* a substance resembling milk, which enters into a large vessel called the *thoracic duct,* and passes upwards to its termination in a large vein near the neck, where it is converted into blood. This blood is not adapted for the nourishment of the body without passing through the lungs, where it is acted upon by the oxygen of the atmosphere, and becomes oxygenated, converted into *arterial blood,* in which state it nourishes the human body, whilst the remaining portions, not containing any nutrient particles, are ejected from the body.

The five organs of sense in connection with the brain are the material instruments by which we enjoy intercourse with the external world.

1. The organ of *vision.* In man, and the higher orders of animals, they are two in number, situated in cavities formed by certain bones of the cranium and face. They are furnished with muscles which move them in every direction, and surrounded by a very soft delicate species of fat, which protects them, and yields to them in all their movements. The eye is composed of a series of tunics, some of which are transparent, containing three diaphanous humours, through which the rays of light are transmitted to the retina, and enables us to perceive objects around us. There are appendages, as the eyebrow, &c., whose offices are to preserve the eye from injury.

2. The organ of *hearing* is a most beautiful but complicated piece of mechanism, and is divided into the external and internal ear, by the musculus tympani, or drum of the ear. The former is on the outside and well known, the latter is contained within the petrous process, or internal portion of the bone. The limits of this lecture, however, will not permit me to give even a concentrated description of this organ.

3. The organ of *smelling.* The seat of this sense is in the cavity of the nose, in which a delicate vascular membrane is distributed throughout its extent, and upon which the olfactory nerves are ramified in great numbers. Its office is the detection of fragrant and unpleasant odours, and to secrete a mucus for its defence.

4. The organ of *taste.* It would be a waste of words to describe the form and situation of the tongue. Besides constituting the organ of taste, it presents a most interesting subject to the physiologist and pathologist, from the concern it has in the functions of mastication, deglutition,

* Denominated the sweetbread by the butchers and the public. It is considered digestible as an article of food, whereas it is directly the contrary, and ought to be avoided, especially by invalids, and ladies when in their accouchement.

and articulation. Its bulk is composed of numerous muscles. It is covered by the continuation of the membrane of the mouth. At the tip, edges, and upper surface of this organ there are numerous projecting processes called papillæ, and in these the sense of taste resides.

5. The organ or sense of *touch*. The whole external surface of the body is covered with a strong elastic integument called the skin. Anatomists divide this into two layers, of which the internal is termed the true skin, while the external is called the scarf skin; a third layer can only be demonstrated in negroes, in which the colour is said to reside: this layer is called the *rete mucosum*: it also exists in Europeans, but is difficult to demonstrate. The use of the skin is to afford protection and support to the organs beneath it, and to exercise a function necessary for our comfort, viz. the exhalation of a gas, the exudation of the perspirable matter denominated in vulgar language *sweat*, and of sebaceous or fatty secretions; while in certain parts, as the head, axilla, pubes, &c., it permits the excresence of hair.

There is a still further proof of the wisdom of Divine Providence, for

"As we are all doomed to die, and be no more seen,"

so he has provided powers inherent in the animal frame, wonderfully mysterious and beyond all human comprehension. Besides possessing internal powers of self-preservation in each individual, yet when two of them act in concert they are endued with the means of producing other animals similar to themselves, which again are possessed of similar functions as their parents were before them; thus being capable of multiplying the species almost without end, or until the world shall cease to exist. These are powers which mock all human inventions (wonderful as they are,) or imitations, and can only be considered as a characteristic of the one and grand Creator of the mighty universe.

The organs concerned in the office of reproduction are distinct and different in the two sexes, and are situated within the cavity of the pelvis, or that portion of the body in the space between the two hip bones; and on this subject the poet (Pope, I believe) justly observes:

"Like leaves on trees the race of man is found,
Now green in youth, now withering on the ground;
Another race the following spring supplies,
They fall successive, and successive rise:
So generations in their course decay,
So flourish these when those are past away."

Thus, my Christian friends, on taking this superficial view of the human body, we perceive that the divine Architect has fitted us with a brain capable of reason; organs of voice for communication with our fellow-creatures; organs for our nutrition, preservation, and reproduction. In fact we may well exclaim with the immortal Pope, that

"The proper study of mankind is Man."

In his youth, the body expands in bulk, the arteries become daily fuller, larger, and longer; his nerves become gradually firmer, and his functions more active. But this is a description of man in his prime of life, when he is neither troubled by disease nor tortured by mental afflictions. Let us now compare him to what he was, as Shakspeare observes, when

"An infant,
Muling and puking in his nurse's arms."

A poor little helpless being, possessing neither sense nor reason to guide him, nor strength to support him, nor abilities to administer to his wants, but by the most piteous shrieks and cries. Were it not that he is at this period supported by maternal affection, he would soon

"Go to that bourne from whence no traveller returns."

Whereas, if we look at the brute creation,* we shall find at this period Providence has made them the superior of man, but only in this solitary instance. The quadruped can walk and feed without help, and, what is more, is even clothed by the omnipotent Deity.

Now let us turn to man in his latter years, when he is about to shake off this mortal coil of infirmities and disease. When old age approaches, the arterial system acts more weakly, the irritability is less, the functions are more weak, the glands diminish in bulk, the fat is absorbed, and the fluids become more acrid. The arteries can no longer conquer the accumulated load in the veins, the brain is overloaded, and serum exhales in the abdomen and under the skin; the glandular vessels cannot propel their fluids, the nerves no longer possess their irritability, and the senses decay. From these causes the limbs grow stiff, the arteries ossify, or are partially converted into bone, the whole system is oppressed with a load it cannot overcome: in fact, the proverb becomes verified,

"Once a man, and twice a child."

Naked and helpless he came into this world, and helpless he goes out of it. His memory fails, his steps faulter, his voice trembles, his health decays, his eyes become dim, and at last his vital functions refuse to perform their office, nature fails, and he expires! Then he becomes as though he had never been. For "the Lord gave, and the Lord hath taken away; blessed be the name of the Lord."

ANALYTICAL TABLES

ILLUSTRATIVE OF THE PRECEDING PAGES.

TABLE I.

SHOWING THE COMPONENT PARTS OF AN ANIMAL BODY.

Solids.

1. Bones.
2. Cartilages { Articular. / Inter-Articular. / Tracheal, and Laryngeal. / Sternal, &c.
3. Ligaments.
4. Membranes { Cellular. / Enveloping. / Serous. / Mucous.
5. Cellular substance.
6. Fat.
7. Muscles.
8. Tendons.

* The feathered tribe are as helpless as ourselves at their escape from the shell, and for some time after.

9. Arteries.
10. Veins.
11. Absorbents.
12. Brain,
13. Spinal marrow, and nerves.
14. Thoracic,
15. Abdominal & pelvic viscera.
16. Secreting glands.

Fluids.

1. Blood.
2. Milk.
3. Bile.
4. Pancreatic juice.
5. Gastric juice.
6. Urine.
7. Tears.
8. Saliva.
9. Mucus.
10. Oil.
11. Synovia.
12. Sweat, or perspirable matter.
13. Cerumen, or ear-wax.
14. Sebaceous matter.
15. Serous fluids.
16. Semen.

TABLE II.

THE FIVE SENSES.

1. The organs of Vision.
2. ——————Hearing.
3. ——————Smelling.
4. The organs of Taste.
5. —————— Touch.

TABLE III.

THE PRINCIPAL ANIMAL FUNCTIONS.

1. Respiration.
2. Circulation.
3. Digestion.
4. Absorption.
5. Irritability.
6. Secretion.
7. Sensation.
8. Generation.
9. Excretion.
10. Integumentation.

TABLE IV.

The various parts of an animal body are technically classed by Anatomists and taught under the following heads :

1. Osteogeny, or the anatomy and physiology of the formation of bone.
2. Osteology, or skeletology——Skeleton.
3. Syndesmology——Ligaments.
4. Myology——Muscles.
5. Angiology——Arteries, veins, and absorbents.
6. Splanchnology——Thoracic, abdominal, and pelvic viscera.
7. Adenology——Glands.
8. Neurology——Brain, spinal marrow, nerves, and organs of sense.
9. Hygrology——Of the composition and physiology of the animal fluids.

The following Tables exhibit a convenient but clear arrangement of the various portions of the human body and the corresponding functions.

TABLE V.

CLASSIFICATION OF THE FUNCTIONS OF LIFE.*

1.—*The Functions of Vivification and Secretion.*

A. The circulation, or the functions of the Heart, Lungs, Blood-vessels, &c.

1. Nutritive circulation.		The Heart and its Blood-vessels.
2. Aërating circulation, or respiration.		The Respiratory Apparatus.
3. Secretory circulation, or secretion.		The action of the blood in the Glandular System.

B. Alimentation, or the functions of the Alimentary Apparatus.

1. Mastication—Mechanical division of the food.			Mouth, Tongue, and Teeth.
2. Insalivation—Mechanical mixture of the aliment.			The mixture of the masticated food with the Saliva.
3. Deglutition or swallowing.	Mechanical conveyance.		Pharynx, and Œsophagus, or Gullet.
4. Digestion and Nutrition.	Chymification, chemical changes, and assimilation.		The Stomach.
	Biliation	Chylification, peculiar mixture with the bile and pancreatic juice.	Duodenum and Ileum.
	Lacteal absorption.	Abstraction of the Chyle from the digested mass.	Lacteal Vessels in the small intestines, and the Thoracic Duct.
5. Peristaltic action of the small intestines.	Causes absorption, and transportation of their contents.		Duodenum, Jejunum, and Ileum.
6. Peristaltic action of the large intestines.	Defecation, transportation, and expulsion of the fæces.		Cœcum, Colon, and Rectum.

2.—*The Functions of Relation and Volition.*

A. General sensation, comprising nervous energy, or inervation.	Central Organs.	The Cerebrum, Cerebellum, and spinal elongation of the medullary substance.
	Distributed Organs.	The Nerves.
B. Peculiar Sensation.	The Organs of Proper Sensation.	The senses of Sight, Smell, Hearing, and Taste.
	The Organs of Common Sensation.	Touch, &c.
C. Voice.	The *Laryngeal* Voice, or Singing,	The Larynx.
	The *Oral* Voice, or Speech.	The Lips, Tongue, and Teeth.
D. Locomotion.	Instruments.	Bones, Cartilages, Ligaments, and Fibro-cartilages.
	Agents.	Muscles, Tendons, and their appendages.

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* Extracted from the Article "Physiology," written by me in Vol. II. of the *British Cyclopædia*, edited by C. F. Partington, Esq.

3.—*The Functions of Procreation and Reproduction.*

The Generative Apparatus in both Sexes.	The Male, or impregnating organs.	Causing a Product.
	The Female, or vitive organs.	The Fœtus.

4.—*Arrest of the Bodily Functions.*—SLEEP.

5.—*Extinction of the Vital and Bodily Functions.*—DEATH.

By the last tables it will be perceived that the organs are arranged according to the physiological purposes, a method adopted by the late BARON HALLER and SÖEMERRING, but it required the hand of the illustrious BICHAT to give it its full and perfect development, and which has since been adopted by Cloquet, and more or less by the eminent continental anatomists. I have, however, made a little variation in the arrangement of the functions of life; in more accordance with the gradual formation of the parts of which the body is composed.

By the above tables, you will perceive at one view an account of the materials of which man is composed. The limits of this Lecture not permitting me to enter into a more general description than I have done in the preceding pages, I shall now describe the chemical analysis of the constituent particles entering into both solids and fluids, in which it will be perceived that the Scriptures are verified, wherein we are informed "that we are created from the dust of the earth."

A MANUAL OF ANIMAL CHEMISTRY, &c.

CHEMICAL ANALYSIS OF THE SOLIDS.

1. THE BONES.

THE human bones have been analysed by Berzelius Fourcroy and Brande. My friend the late Mr. Joshua Brookes, in his lectures on this subject,* stated them to be as follows:—

Phosphate of lime	63
Gelatin	23
Carbonate of lime	2
Loss in the examination	2
	90†

The teeth have been analyzed by Professor Berzelius, of Stockholm, and the following forms the result of his analysis:‡—

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* MS. Notes of lectures on anatomy, physiology, and surgery, delivered by Joshua Brookes, Esq., 1821-26, taken during twelve courses by H. W. Dewhurst, vol. i. p. 3.

† One hundred parts of bone are reduced by calcination to sixty-three, according to Berzelius.

‡ *Nicholson's Journal*, vol. xviii. p. 75.

Bony part of Human Teeth.

Phosphate of lime	61·95
Fluate of lime	2·10
Carbonate of lime	5·50
Phosphate of Magnesia	1.05
Soda, with a little muriate of soda	1.40
Gelatin, water, &c.	28·00
	100·

Enamel of Human Teeth.

Phosphate of lime	85·3
Fluate of lime	3·2
Carbonate of lime	8·0
Phosphate of lime	1·5
Soda, animal and water	·2
	100·

In addition to my preceptor, the bones have been analyzed by Mr. Hatchett, Professor Brande, Berzelius, M. Jules Cloquet, M. M. Fourcroy and Vauquelin, and Beclard; but, strange to say, none agree in the same results.*

2. The Muscles.

The muscles of animals chiefly consist of fibrin, albumen, gelatin, extractive matter, phosphates of lime, soda, ammonia, carbonate of lime, and sulphate of potass.

3. The Membranous Tissue.

Membranes of animals consist of concrete gelatin, and are, like skins, convertible into leather by tanning.

4. The Brain.

The brain has long been known to anatomists; but it is only of late years that chemists have paid it any attention. It has been analyzed by Vauquelin, and, according to his examinations, there is no difference of composition in the various portions of the nervous system. Of the analysis of the brain, cerebellum, spinal marrow, and nerves, he gives the same result. He found in them all the same matter, the composition of which is as follows:—

Water	80·00
White fatty matter	4·53
Red fatty matter	0·70
Ozmazome†	1·12
Albumen	7·00
Phosphorus	1·50
Sulphur and Salts, such as Phosphate of Potass, ——— Lime, ——— Magnesia	5·15

* I am preparing a Course of Demonstrations on the minute Anatomy and Physiology of the Human Skeleton for publication, wherein the investigations of these philosophers will be discussed.

† *Ozmazome* is a peculiar animal principle found in the muscles. It has a brownish yellow colour, with the taste and smell of soap.—Dr. Ure.

Monsieur John has ascertained that the brown matter of the brain does not contain phosphorus; and Monsieur Chevreul has recently discovered a white and pearly substance which he considers a proximate principle proper to the nervous system.

This organ is larger in man than in any other known animal, in proportion to the size of the nerves arising from it: its general weight is, according to Soëmmering, from 2 lb. 5½ oz. to 3 lb. 3¾ oz. I have weighed several at 4 lb.* The brain of the late Lord Byron (without its membranes) weighed 6 lb., and contained more medullary substance than ordinary:† as also did that of Oliver Cromwell. That of the late Dr. Gall weighed only 2 lb. 10 oz. 7½ drs. Here is a very curious difference, and neither can be said to be deficient in intellect. The weight of Dr. Spurzheim's brain I have not been able to procure. Baron Cuvier's brain weighed, according to the report of Monsieur Berard, professor at *L'Ecole de Medecin*, Paris, 3 lbs. 13½ ozs.; but by Monsieur Rousseau's statement it was 3 lbs. 14 ozs. 4 drs. Thus much for the gravity of the human brain, which has no doubt more or less influence on the mental manifestations, according to the phrenological doctrine *that size is indicative of power*. The brain of a horse weighs only 1 lb. 4 oz. Dr. Monro found that of an ox to be one-fourth the dimensions of the human brain; and Captain Scoresby, jun., weighed the brain of a Greenland whale (the *Balæna Mysticetus*), 19 feet long, and it only weighed 3¾ lb., although the animal weighed nearly 11,200 lb. The weight of the brain was nearly the $\frac{1}{3000}$th part of the body.‡

Having slightly mentioned the phenomena of the human mind at page 6, I here insert a condensed analysis of the various powers or faculties, premising that it is founded on the following basis, from long and extensive observation.

First.—That the brain is the material instrument through the medium of which the mind carries on intercourse with the external world.

Secondly.—That the mind is not matter, or composed of any material substance, although it depends upon the brain being well constructed in all its portions; it therefore, though *not matter itself*, yet the due performance of its mysterious and multifarious functions depends upon matter.

Thirdly.—That the brain is composed of an aggregate number of parts or organs, each of which has a special or determinate function or faculty to perform.

Fourthly.—That the exterior of the skull generally partakes of the form of the brain within, and that by an inspection of it externally a pretty accurate idea of the mental manifestations of the individual can be ascertained.

THE MENTAL FACULTIES OF MAN are thus divided:—

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* *Dissertation on the Component Parts of the Animal Body*, being a Lecture introductory to the Study of Human, Comparative, and Physiological Anatomy. Third Edition. By H. W. Dewhurst. 1831.

† *Medwin's Conversation*, Appendix, p. 520, § 6.

‡ *Voyage to the Arctic Regions*, vol. i. 1823.

GENUS I.—THE ANIMAL PROPENSITIES, by which the human being is placed on a level with the inferior and surrounding animals.

Organ.	Use.	Effect.
1. Amativeness.	———	Desire for connubial enjoyment with the opposite sex—effect, the procreation of offspring.
2. Philoprogenitiveness.	———	Affection for offspring—love of children and young and helpless creatures generally.
3. Inhabitiveness.	Attachment for particular places.	Creates a love of country.
4. Adhesiveness.*	Attachment to particular persons.	Constitutes the source of friendship.
5. Combativeness.	Boldness, courage.	Causes a propensity to retaliate for real or supposed injuries.
6. Destructiveness.†	The destructive energy	Necessary for the well-being of society, and all who live on animal food.
7. Secretiveness.	Fondness for secrecy.	Produces that mysterious concealment which veils the actions of many persons, creates deceit and dissimulation when largely manifested.
8. Acquisitiveness.	The desire to possess.	Gives the innate disposition to acquire property.
9. Constructiveness.	———	Fondness for contrivance; invention.
10. Self-esteem.	———	The feeling of pride, or personal dignity.
11. Approbativeness.	———	Desire of the esteem and approval of others.
12. Cautiousness.	Apprehension of danger.	Prudence in the various affairs of life.
13. Alimentiveness.	———	Discrimination of tastes and flavours.

GENUS II.—MORAL SENTIMENTS, or those faculties which give man a sense of good and evil, and generally are peculiar to him alone.

14. Benevolence.	———	Compassion for the friendless and distressed.
15. Veneration.	———	Reverence for the Supreme Being, and superiors in general, as also ancient works of art, religious relics, &c.
16. Firmness.	Feeling of determination, perseverance.	The reverse is obstinacy, violent self-will, &c.
17. Justice or conscientiousness.	The expectation of moral fitness.	When large it creates a fulfilment of the great commandments—"Be just one unto another"—"Do unto others as ye would they should do unto you," &c.
18. Hope.	The expectation of some future benefits.	The reverse of this causes melancholy and despair.
19. Marvellousness.	———	Creates a disposition to believe in things and events that are supernatural and out of the usual course of nature.
20. Imaginativeness, or ideality.‡	———	A sensation of the beautiful and perfect, particularly of the past and future events. It stimulates the poet, historical painter, and sculptor, &c.

* Since I published my *Grammar of Phrenology*, in June 1834, I have changed the name of this organ to *Amicitiveness*, as more expressive of its meaning; the Latin word *amicitia* signifying friendship.

† This has been called the organ of *murder*, but erroneously: there is *no such organ*; it is only when the moral sentiments and intellectual faculties are small developed, and this organ with combativeness largely manifested, that those dreadful events occur which prove fatal by ending in murder.

‡ I have long employed the term *imaginativeness*, conceiving it a more appropriate appellation.

Organ.	Use.	Effect.
21. Wit or mirth.	Perception of the disjunction or incongruity of ideas.	Gives the power of punning.
22. Imitation.*	———	Inclination to copy.

GENUS III.—THE INTELLECTUAL FACULTIES.—These are situated in the forehead, and are peculiar to man only.

23. Individuality.	———	To perceive individual objects.
24. Configuration, or form.	———	To denote shape, or configuration.
25. Size.	———	To take cognizance of magnitude, or dimension.
26. Weight.	———	To estimate the gravity of bodies.
27. Colour.	———	To notice the perception of tints and colours generally.
28. Locality or space.	To perceive space with its relations.	Creates the propensity of travelling and emigrating to foreign climes.
29. Calculation or number.	———	To recollect the properties of numbers, and arithmetical calculations.
30. Order.	———	To observe strictly the disposition of things.
31. Eventuality.	———	To take cognizance of events.
32. Time or duration.	———	To perceive the process of duration.
33. Melody or tune.	———	To notice the properties of melodious, and other sounds.
34. Language.	———	Is the power of learning words.

GENUS IV.—THE REFLECTIVE FACULTIES.—These are productive of the ideas of relation and reflection. They administer to the qualification and direction of the other powers, and constitute what we call, in common language, REASON.

35. Comparison.	———	Perception of the agreement and congruity of ideas.
36. Causality.	———	Perception of cause and effect.

THE FLUIDS.

1. THE BLOOD.

THE blood is a fluid, which first presents itself to our observation when the parts of living animals are divided or destroyed; it circulates with considerable velocity through the arteries and veins.† This fluid consists of about three parts of a straw-coloured fluid denominated serum, to one of a cake-like substance called the cruor.

According to the late Dr. Marcet, the serum is composed in 1000 parts of

Water	900·
Albumen	86·8
Muriates of potass and soda	6·6
Muco-extractive matter	4·0
Subcarbonate of soda	1·65
Sulphate of potass	0·35
Earthy phosphates	0·60
	1000·

* This is found in many of the lower animals, particularly the monkey genus.

† The circulation of the blood was discovered by Dr. Wm. Harvey, the maternal ancestor of the present Earl of Winchelsea, in 1620, and publicly taught in 1628. See *Dewhurst's Dictionary of Anatomy and Physiology.*

On an analysis by Berzelius, he found the cruor consists in 100 parts, of

Fibrin	36
Colouring matter	64+100
Albumen	a little
The specific gravity, about	1·245*

2. Milk.

This fluid is well known, and is secreted in peculiar vessels formed in the breasts of the females of the human species, of quadrupeds, and of cetaceous animals; it is destined for the purpose of nourishing their young.

Milk, according to Berzelius, consists of

	Parts.
Water	928·75
Curd, with a little cream	28·00
Sugar of milk	35·00
Muriate of potash	1·70
Phosphate of potash	0·25
Lactic acid, acetate of potash, with a trace of lactate of iron	6·00
Earthy phosphates	0·30
	1000·

3. Saliva

Is a fluid secreted in the mouth, which flows in considerable quantity during a repast. Besides water, which constitutes at least four-fifths of its bulk, it contains the following ingredients :—

1. Mucilage
2. Albumen
3. Muriate of soda
4. Phosphate of soda
5. Phosphate of lime
6. Phosphate of ammonia.

4. Tears.

A peculiar fluid, secreted by the lachrymal gland, employed in lubricating the eye, and which is emitted in considerable quantities when we express *grief* or *joy* by weeping. They are composed of

1. Water
2. Mucus
3. Muriate of soda
4. Soda
5. Phosphate of lime
6. Phosphate of soda.

The saline particles amount to about 0·01 of the whole, if so much.

5. Bile.

The bile is a fluid secreted in the liver, by the extremities of a large vein called the *vena porta*, which ramifies through that organ; its use is to assist digestion. According to Monsieur Thenard, it is composed in 1,100 parts of

* See *Dewhurst's Dictionary of Anatomy and Physiology*, article Blood.

Water	1000
Yellow insoluble matter	from 2 to 10
Albumen	42
Resin	41
Soda	56
Phosphates of lime and soda, sulphate of soda, muriate of soda, and oxide of iron.	45

7. Sweat, or Perspirable Matter.

Human sweat, according to M. Thenard, is formed of a great deal of water, free acetous acid, muriate of soda, an atom of phosphate of lime and oxide of iron, and an inappreciable quantity of animal matter, which approaches nearer to gelatin than any other substance.

8. Synovia, or Joint-oil.

This fluid, according to Monsieur Margueron, is composed of

	Parts.
Fibrous matter	11·86
Albumen	4·52
Muriate of soda	1·75
Soda	71
Phosphate of soda	70
Water	80·46
	100·

CONCLUSION.

I have, in a few words, my Christian friends, endeavoured to give you some idea of the materials of which you are created. Man is, to use the words of the immortal Shakspeare, "The beauty of the world, and the paragon of animals." Let him but look at himself, and with all his boasted endowments, skill, and acknowledged ingenuity, he shall be lost in amazement at his own structure, and unable to account, physiologically, for the various and complicated processes which are constantly going on in the human frame. Think on what I have stated, and you will be ready to exclaim with the illustrious royal Psalmist, "O Lord, I will praise thee, for I am fearfully and wonderfully made: marvellous are thy works; and that my soul knoweth right well." And you cannot but be totally devoid of every symptom of gratitude, if you do not, with every feeling of humility and thankfulness, acknowledge yourself to be the handy work of an Omnipotent Creator!

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